

Geo-Environmental Assessment
Land Adjacent to 35 Ashwell Street, Ashwell
SG7 5QR

Client: Ms. N. Oates & Ms. S. Smith

Issue Date: June 2025
Report Ref: 21362R1 (Issue A)



CONTAMINATION



FOUNDATIONS



DRAINAGE





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FIGURES

Figure 1 – Site Location Plan

Figure 2 – Proposed Site Plan/Areas of Concern

Figure 3 – Intrusive Location Plan

APPENDIX A

Relevant Guidance and Legislation

APPENDIX B

Site Photos

APPENDIX C

Environmental Database

APPENDIX D

Field Logs

APPENDIX E

Permeability Sheets

APPENDIX F

Analytical Test Results

APPENDIX G

Geotechnical Test Results



1.0 EXECUTIVE SUMMARY

Phase 1 Desk Study	Comments	Risk Rating
Site Setting	The current site comprises an area of recently cleared land that is mostly soft-standing grass. Access is via Ashwell Street to the north	Low
Published Geology and Hydrogeology	- Bedrock geology: Holywell Nodular Chalk Formation, Melbourn Rock Member (chalk), Zig Zag Chalk Formation - Superficial geology: None recorded - Hydrogeology: Principal aquifer within SPZ III (outer zone)	Moderate
Radon	Low risk (<1%)	Low
Hydrology/Flood Risk	- River Rhee located 327m N of site - Negligible risk of flooding	Low/Moderate
Historical land use	The subject site appears to have been undeveloped since 1877 but may have formed part of a nearby unspecified depot in 1951	Low/Moderate
Landfill/Infilled land	- No historical landfills within 250m of site - Historical pit 2m W of subject site (1948)	Low
UXO	Low risk	Low
Phase 2 Intrusive	Comments	Risk Rating
Proven Ground Conditions	- Topsoil to 0.20m bgl - Made Ground to a max depth of 0.30m bgl - White Chalk (Grade Dm:Dc) to 4.00m bgl	
Groundwater/Drainage	- Groundwater not encountered within the upper 4m - Borehole soakage value of E-03m/sec within the chalk	Low
Contamination	- Stockpile of ACM identified during site walkover, which is due to be removed - No visual contamination identified - No exceedances of the adopted GAC's for residential land use	Low
Ground Engineering	Shallow strip foundations are feasible within the chalk, adopting an allowable bearing capacity of 225 kPa at a minimum depth of 1m bgl	Low
Recommendations	- Validation of surface soil following ACM removal - BRE365 soakage testing for drainage design	

2.0 INTRODUCTION

WDE Consulting Limited (WDE) was appointed by Ms. N. Oates & Ms. S. Smith (the *client*) to conduct a Geo-Environmental Assessment at Land Adjacent to 35 Ashwell Street, Ashwell, SG7 5QR (Figure 1). The current site comprises an area of recently cleared land that is mostly soft-standing grass and is situated at NGR TL 26880 39407, What 3 Words *trophy.bunch.flooding* (Figure 2).

2.1 Context

It is understood that the proposed development comprises the construction of two detached 4-bedroom dwellings with associated garages and access under planning ref. 21/02650/FP issued by North Hertfordshire District Council (Figure 2).

The works have been completed in line with the current regulations, guidance and good practice presented in Appendix A.

2.2 Agreed Scope of Works and Objectives

The scope of work that was agreed with the client is presented in Table 1.

Table 1 – Agreed Scope of Works and Objectives

Item	Scope of Works	Objectives
1	Phase 1 Desk Study	- Complete a site walkover - Complete a desk-based study of the site to ascertain information on the site geology, hydrology, and surrounding land uses.
2	Intrusive site investigation	- To identify whether there is any contamination onsite which is considered to pose an unacceptable risk to human health, controlled waters or the environment. - To identify the geotechnical properties of the ground to enable design parameters for foundations and drainage.
3	Permeability testing	Investigate the indicative drainage potential of the materials through borehole permeability testing.
4	Laboratory analyses	Contamination and geotechnical soil samples are analysed at a UKAS accredited laboratory.
5	Reporting	- Compare onsite soil concentrations with generic UK based assessment criteria. - Provide recommendations on contamination, foundations, and drainage.

3.0 PHASE 1 DESK STUDY

3.1 Information Sources

The sources of information that were used during the desk study included the following items:

- Site walkover (photos presented in Appendix [B](#))
- Environmental database information (Appendix [C](#))
- Publicly available information

3.2 Site Description and Walkover

The subject site measures ~60m E-W and ~85m N-S with an L-shaped area of ~0.28ha (Figure 2)

The current site comprises an area of recently cleared, mostly soft-standing land that is uneven underfoot and overgrown in places. There is evidence of a historical ~10m by ~3m garage in the northwest corner of the site that has since been demolished and now consists of a concrete hardstanding and ~0.3m tall retaining wall. There are various materials stored on site as well as scattered objects and debris. These include piles of timber, construction materials, and other household items (Photo 1). There are a variety of trees including a mature horse chestnut, blackthorn, hawthorn, ash, as well as semi-mature fruit trees, possibly apple (Photo 2).

During the site walkover a ~1m³ pile of asbestos containing materials (ACM) in the form of asbestos/cement sheeting was identified on the northern boundary near the previous garage building (Photo 3). It is understood that this ACM is due to be removed.

No signs of gross contamination, bulk fuel tanks or surface staining was observed.

3.3 Key Findings of Desk Study

The key findings from the desk study are presented in Table 2.

Table 2 – Key Findings of Desk Study

Item	Details
Published geology	Published geology indicates Holywell Nodular Chalk Formation in the southeast of the site, with Melbourn Rock Member (Chalk) in the west and north of the site, and Zig Zag Chalk Formation in the far northwest near the access point via Ashwell Street. There are no published superficial deposits.
Geological hazards	All negligible/very low.
Hydrogeology	The bedrock has been deemed a Principal Aquifer, and the site lies within a Source Protection Zone 3.

Item	Details
Hydrology/flood risk	The nearest surface water is the River Rhee 327m N. There is a negligible risk of surface water flooding, and the site lies outside a flood zone.
Current land use on site	Used for storage of construction materials. It has recently been cleared of overgrown vegetation.
Current land use within 250m radius	• 107m N, 206m W – Electrical substation • 158m S – Pumping station • 190m S – Gas governor • 205m NW – Telephone exchange • 228m NW – Snow refrigeration
Historical land use on site	Site undeveloped since 1877 but may have formed part of a nearby unspecified depot in 1951. Recent aerial photograph indicates the garage is present from around 2015.
Historical land use with 250m radius	• Unspecified Pit - 2m W (1948), 9m SW (1948), 11m SW (1947), 12m SW (1951), 23m SW (1982), 29m NE (1951) • Unspecified Depot - 12m NW (1982) • Timber Yard - 14m N (1921), 15m N (1947) • Chalk Pit - 14m SW (1921), 23m W (1903), 27m W (1897), 27m NE (1921), 27m NE (1947), 31m NE (1948), 35m NE (1903) • Lime Kiln - 15m W (1882), 34m W (1886), 106m NE (1886) • Corn Windmill - 17m E (1886), 32m NE (1882), 80m W (1886) • Unspecified Quarry – 42m NE (1982) • Unspecified Ground Workings – 50m NE (1982), 56m NE (1882), 88m NW (1882), • Burial Ground – 80m NE (1886), 119m N (1882) • Water Works – 115m S (1948), 118m S (1921), 118m S (1947) • Pumping Station - 157m S (1982) • Unspecified Heap – 158m (1948) • Unspecified Factory – 200m SW (1982)
Landfills/infilled land	No historical landfills within 250m of site. There are a number of ground workings and worked ground within 100m of the subject site.
Identified potential areas of concern	• A: Potentially imported made ground • B: High water demand trees/mature trees • C: Asbestos cement sheeting • D: Unspecified pits and chalk pits within 50m of site • E: Historical garage
Pollution incidents	None recorded
Radon risk	Less than 1% (Low risk).
UXO risk	Low risk
Environmental Sensitive Land Uses	Existing surface water and groundwater nitrate vulnerable zone identified onsite.

3.4 Contamination Preliminary Risk Assessment

3.4.1 Identification of Critical Receptors

The identified potentially critical receptors are presented in Table 3.

Table 3 – Identification of Potential Receptors

Receptor Type	Current/Future	Receptor Details	Active
Human Health	Future	Residential receptors onsite	Yes
	Future	Construction workers onsite	Yes
	Current	Residential receptors offsite	Yes
	Future	Public Open Space	No
Controlled waters	Current	Groundwater within Principal Aquifer	Yes
	Current	Groundwater within SPZ	Yes
	Current	Surface water body within 250m	No

The risks to onsite workers can be minimised by following appropriate health and safety guidance on site (i.e. wearing protective clothing and washing).

3.4.2 Identification of Potential Areas of Concern

The list of potential areas of concern on site and in the surrounding area are summarised in Table 4, and presented on Figure 2.

Table 4 – Identification of Potential Areas of Concern

Ref Area of Concern	Location	Potential Risk	Comments
A	Onsite	Potentially imported made ground	Hydrocarbons (TPH, BTEX, PAH), heavy metals, inorganics, asbestos, cyanide, phenols, ground gas
B	Onsite	Tree	Mature high water demand trees
C	Onsite	Asbestos cement sheeting (ACM)	Asbestos
D	Offsite	Historical unspecified/chalk pits	Hydrocarbons (TPH, BTEX, PAH), ground gas
E	Onsite	Historical Garage	Hydrocarbons (TPH, BTEX, PAH), heavy metals, inorganics, asbestos

3.4.3 Identified Potential Pathways

Human Health Pathways

The potential human health exposure pathways for a residential receptor are indicated in Table 5.

Table 5 – Identification of Potentially Active Human Health Exposure Pathways

Potential Pathway	Active/ Inactive	Notes
Ingestion of soil and dusts	Active	Qualitative Risk Assessment required.
Dermal contact with soils and dust	Active	Qualitative Risk Assessment required.
Ingestion of home grown produce	Active	Qualitative Risk Assessment required.
Inhalation of dusts	Active	Qualitative Risk Assessment required.
Inhalation of organic vapours (generated by shallow soils) in external areas or inside buildings	Active	Qualitative Risk Assessment required.
Inhalation of organic vapours generated by dissolved phase groundwater migrating offsite to neighbouring residential properties	Active	Qualitative Risk Assessment required.
Inhalation of organic vapours generated by dissolved phase groundwater migrating onto site from surrounding offsite sources	Active	Qualitative Risk Assessment required.
Contaminants from site entering groundwater and migrating into public water abstraction borehole for human consumption	Inactive	No potable abstractions within 500m. No further assessment necessary.

Controlled Waters Pathways

The potentially active controlled waters migration pathways are indicated in Table 6.

Table 6 – Identification of Potentially Active Controlled Water Pathways

Potential Pathway	Active/ Inactive	Notes
Impacted soils leaching to groundwater within Principal Aquifer	Active	Qualitative Risk Assessment required
Impacted soils leaching to groundwater and migration to surface water	Inactive	No surface water within 250m of site. No further assessment required

3.4.4 Qualitative Risk Assessment

A summary of the relevant pollutant linkages based on a source-pathway-receptors analysis is provided in Table 7.

Table 7 – Summary of Potentially Active Source-Pathway-Target Assessment

Sources	Potential Pathway	Potential Receptor	Risk Classification
Onsite Sources (See Table 4)	Dermal contact, outdoor and indoor inhalation, ingestion, homegrown produce	Human Health (Onsite Residential)	Moderate
	Vapour inhalation from dissolved phase groundwater migrating from site to neighbouring properties	Human Health (Offsite Residential)	Moderate
	Impacted soil leaching to groundwater within Principal Aquifer	Controlled Waters (Groundwater)	Moderate
Offsite Source (See Table 4)	Vapour inhalation from dissolved phase migration from offsite sources	Human Health (Onsite Residential)	Low/Moderate

3.5 Ground Gas Preliminary Risk Assessment

3.5.1 Potential Sources for Ground Gas Generation

A summary of the potential sources for ground gas generation is presented in Table 8.

Table 8 – Identification of Potential Sources for Ground Gas Generation

Potential Source	Yes/No	Notes
Potential for natural materials with high organic content, such as peat (>4% TOC)	Yes	Further assessment required.
Availability of readily degradable material, such as vegetable matter and food waste	No	No further assessment required.
Nature of fill material - depth of fill >1m, incohesive materials, poorly compacted and within unsaturated zone.	Yes	Further assessment required.
Age of Materials - Ground gas generated from current/historical landfills <25yrs old	No	No landfills or mine workings <25yrs old recorded within 250m of site. No further assessment required.
Chemical storage/spillages with potential for hydrocarbon vapours	Yes	Previous vehicle garage onsite. Further assessment required.
Shallow or deep mine workings	No	No further assessment required.
Source of Radon gas	No	<1% risk of radon. No further assessment required.

3.5.2 Potential Ground Gas Pathways

The potential for ground gas risk depends on source-pathway-receptor linkages, with the age of infilling and type of waste as controlling factors. The potentially active migration pathways for ground gas are indicated in Table 9, along with a qualitative risk assessment.

Table 9 – Identification of Potentially Active Ground Gas Pathways

Potential Pathway	Yes/No	Notes
Distance from receptor – a higher distance reduces the potential risk for offsite migration. High risk generally limited to within 100m distance.	Yes	Residential receptors within 150m of site.
Presence of Preferential Pathways – fissures/fractures in bedrock or permeable strata beneath an impermeable cover	Yes	Published bedrock geology is chalk with no recorded superficial deposits

3.5.3 Potential Ground Gas Receptors

A summary of the receptor assessment is provided in Table 10.

Table 10 – Summary of Receptor Assessment for Ground Gas

Items	Yes/No	Notes
Does the receptor comprise a new building?	Yes	Proposed development is likely to comprise new dwellings.
Are there reports of ground gas from neighbouring properties?	No	No further assessment required.

3.5.4 Preliminary Ground Gas Risk Assessment

A summary of the preliminary ground gas risk assessment is presented in Table 11.

Table 11 – Summary of Preliminary Ground Gas Risk Assessment

Identified Potential Sources	Identified Active Potential Pathways	Potential Receptors	Qualitative Risk Assessment
Potential for natural materials with high organic content, such as peat (>4% TOC)	Onsite/offsite migration of gas and vapour through fissures/fractures in chalk	Receptor likely to comprise new buildings. Residential receptors within ~15 - 20m of the site.	Moderate
Nature of fill material - depth of fill >1m, incohesive materials, poorly compacted and within unsaturated zone.	Offsite migration of gas and vapour through fissures/fractures in chalk and poorly compacted fill materials associated with worked ground	Residential receptors within ~15 - 20m of the site	Moderate
Chemical storage/spillages with potential for hydrocarbon vapours	Onsite/offsite migration of gas and vapour through fissures/fractures in chalk	Receptor likely to comprise new buildings	Moderate

4.0 PHASE II INVESTIGATION WORKS

4.1 Summary Of Works

The locations of the intrusive investigation are presented on Figure 3 and comprised the following:

Table 12 – Summary of Phase II Intrusive Works

Item	Details	Appendix
Shallow Boreholes (Photo 4)	5no boreholes (BH1 to BH5) with SPTs to a maximum depth of 4.0m bgl	D
Dynamic Probes	2no dynamic probes (DP1 to DP2) to a maximum depth of 2.0m bgl	
Permeability testing	2no borehole permeability test locations (BH2 & BH4)	E
Analytical Testing	Representative samples sent for analytical testing	E
Geotechnical Testing	Representative samples sent for geotechnical testing	G

4.2 Constraints/Selection of Intrusive Locations

No constraints were encountered during the intrusive investigation.

4.3 Rationale for Selection of Intrusive Locations

The intrusive locations are indicated on Figure 3, with rationale used for the selection of locations presented in Table 13.

Table 13 – Rationale for Exploratory Hole Locations

Area of concern	Location	Description	Intrusive Locations
B	Central Portion	Mature trees	BH1, BH2, BH4, BH5
D	Northwestern Portion	Historical unspecified/chalk pit	BH3, BH4, BH5
E	Western Portion	Historical garage	BH3
-	Northern Portion	Future driveway	DP1, DP2, BH4, BH5
-	Remainder of site	Site coverage for proposed infrastructure	All

4.4 Field Results

4.4.1 Geology

A summary of the geology encountered during the intrusive investigation is summarised in Table 14 and are presented in full Appendix [D](#).

Table 14 – Summary of Geology Proved Onsite

Strata	Descriptions	Min - Max Depth (m bgl)	Average Depth (m bgl)	Locations
Topsoil		0.20 – 0.25	Absent - 0.20	BH4, BH5
Made Ground	Brown silty clay with charcoal, tile, slate and red brick fragments	0.30	Absent – 0.30	BH1, BH2, BH3
Chalk	White chalk (Dm:Dc)	1.10 – 4.00+	0.30 - 4.00+	All

BH1 encountered hard/dense materials at 1.10m and at 4m depth in BH3 and BH5, which is likely to represent less weathered bedrock.

4.4.2 Groundwater

Groundwater was not encountered during the investigation.

4.4.3 Contamination Observations

The stockpile of asbestos sheeting (ACM) identified during the site walkover is understood to be shortly removed from site.

No grossly contaminated materials were identified during the intrusive investigation.

4.4.4 Permeability Results

A summary of the borehole permeability testing results is presented in and are presented in full in Appendix E.

Table 15 – Indicative Soakage Test Results

Location	Test Type	Material	Depth of Test m bgl	Test No	Drainage (m/sec)	Adopted Value (m/sec)	Qualitative Soakage Potential
BH2	Borehole	Chalk	4.00	1	1.30E-04	1.30E-04	Good
BH4	Borehole	Chalk	4.00	1	>10-04	>10-04	Good

5.0 CONTAMINATION ASSESSMENT

5.1 Soil Analytical Test Results

Based on the context of the assessment, the proposed land use is assumed to be residential dwellings with private gardens. A comparison of the soil analytical test results with the adopted GACs is presented in Appendix E, along with laboratory certificates of analyses.

A total of 3 out of 3 samples have complied with the adopted GACs.

5.2 Waste Classification/Onsite Reuse Options

Table 16 provides an overview of the likely waste classification for onsite materials, as well as onsite reuse options, with the waste classification sheets presented in Appendix F.

Table 16 – Likely Waste Classification/Reuse Options for Onsite Materials

Material	Waste Classification	On Site Reuse Options
Made Ground	Non-hazardous	Beneath roads, hardstanding
Natural Materials	Inert	All scenarios except surface cover

Reuse of site won materials is to be encouraged in line with a sustainable approach, which will require a CL:AIRE DoW:CoP Materials Management Plan (MMP) or U1 waste exemption form to be completed.

5.3 Updated Contamination Risk Assessment

There have been no exceedances of the adopted GACs for contaminants, and a revised *source-pathway-receptor* assessment is presented in Table 17.

It is recommended that additional verification is undertaken of the surface soils following the removal of the ACM.

Table 17 - Summary of Revised Active Source-Pathway-Target Assessment

Sources	Potential Pathway	Potential Receptor	Risk Classification
Onsite Sources (Table 4)	Dermal contact, outdoor and indoor inhalation, ingestion, homegrown produce	Human Health (Onsite Residential)	Low
	Vapour inhalation from dissolved phase groundwater migrating from site to neighbouring properties	Human Health (Offsite Residential)	Low
	Impacted soil leaching to groundwater within Principal Aquifer	Controlled Waters (Groundwater)	Low
Offsite Source (Table 4)	Vapour inhalation from dissolved phase migration from offsite sources	Human Health (Onsite Residential)	Low

5.4 Updated Ground Gas Risk Assessment

An update to the ground gas risk assessment is presented in Table 18 which has incorporated the results obtained from this assessment.

Table 18 – Updated Ground Gas Risk Assessment

Potential Source	Site Value	Comment	Quantitative Risk Assessment
Potential for natural materials with high organic content, such as peat (>4% TOC)	Max TOC value of 2.9 %	No highly organic or peaty material identified. No viable source for ground gas	Very Low
Nature of fill material - depth of fill >1m, incohesive materials, poorly compacted and within unsaturated zone.	Max thickness of 0.30 m	No elevated TOC value within made ground. No viable source for ground gas	Very Low
Chemical storage/spillages with potential for hydrocarbon vapours –	No elevated PID readings or concentration of volatile contaminants identified	Receptor likely to comprise new buildings	Very Low

The revised ground gas risk assessment indicates a very low risk from ground gas (*NHBC Green*). There is unlikely to be a requirement for further ground gas monitoring visits.

6.0 GROUND ENGINEERING

6.1 Field Testing Results

A summary of the ground engineering field testing results is provided in Table 19 and are presented in on the logs in Appendix D. This includes the calculated SPT N value and inferred shear strength (Cu) using a pocket penetrometer (PP).

Table 19 – Field Geotechnical Results

Depth (m)	BH1	BH2	BH3	BH4	BH5
	N Value	N Value	N Value	N Value	N Value
1.0	93	23	18	25	20
2.0	-	18	19	30	28
3.0	-	28	19	38	23
4.0	-	23	43	25	43

6.2 Geotechnical Testing

Particle size distribution (PSD), Triaxial undrained shear strength (Cu) and Atterberg limit (PI) testing of the encountered strata are summarised below in Table 20 with the full results presented in Appendix G.

Table 20 – Summary of Geotechnical Test Results

Description	Average Depth (m bgl)	SMC (%)	Intact Dry Density (mg/m ³)
Chalk	0.30 – 4.00	23.6 – 30.5	1.45 – 1.62

The intact dry density of 1.45 – 1.62 and saturation moisture content of 23.6 – 30.5 indicates a low to medium CIRIA¹ chalk density.

6.3 Concrete Design Parameters

A summary of the sulphate, pH and corresponding BRE³⁶ concrete in aggressive ground parameters for concrete design are presented in Table 21.

¹ CIRIA 2002. Engineering in Chalk. C674

Table 21 – Summary of BRE Concrete in Aggressive Ground Parameters

Location	Concrete Parameters
pH (pH Units)	8.1 – 8.2
Water Soluble Sulphate as (2:1 Leachate Equivalent) (mg/l)	10.4 -12.7
ACEC Classification	AC-1
Design Sulphate Class	DS-1

6.4 Comparison with Water UK Threshold Concentration Values

Selection of inappropriate water pipe materials for the conditions of the site could have significant consequences and pollute the water supply. An assessment of the chemical contamination and selection of suitable pipe material has been undertaken in line with current guidance^{24, 25}.

The soil laboratory results from the upper 1.35m have been compared to the UKWIR thresholds for the selection of water supply pipes in Table 22 with full results presented in Appendix F.

Table 22 - Comparison of Soil Laboratory Results from the upper 1.35m with UKWIR (mg/kg)

Parameter Group	No. of Samples	UKWIR Threshold for Pipe Type				Max	Samples Exceeded
		PE	PVC	Barrier	Steel/Fe/Cu		
Total BTEX & MTBE	3	0.1	0.03	Pass	Pass	BDL	-
C5-C10 aliphatic and aromatic	3	2	1.4	Pass	Pass	BDL	-
Mineral oil C11-C20	3	10	Pass	Pass	Pass	BDL	-
Mineral oil C21-EC40	3	500	Pass	Pass	Pass	BDL	-
Phenol	3	2	0.4	Pass	Pass	BDL	-
Cresols/chlorinated phenols	3	2	0.04	Pass	Pass	-	-
Corrosive	3	Various				8.1	-

There have been no exceedances of the UKWIR threshold values and therefore it is unlikely that additional mitigation measures in the form of protective pipe will be necessary. Further consultation should be sought with the water supply company.

6.5 Excavations, Groundwater Control and Services

Groundwater was not encountered during the investigation within the upper 4.00m so is unlikely to require dewatering for shallow excavations. Excavations within the cohesive materials are unlikely to require additional support.

6.6 Preliminary Road Design Parameters

6.6.1 Frost Susceptibility

Precautions should be put in place to limit the potential weakening of the chalk caused by freeze/thaw actions¹, which include the following:

- Limit exposure of chalk during winter periods via retaining >600mm thickness of overburden or protective layer
- Highway pavements to be at least 450mm thick for future developments.

6.6.2 CBR value

Typical CBR design value of 2% should be adopted for structureless chalk¹, whereas structured chalk has a value of 15%.

NHBC³⁵ has provided guidance on minimum CBR values required for roads (5%) and paved areas (2%). A summary of the CBR values obtained from in-situ dynamic probing is presented in Table 23 and are provided in full in Appendix G.

Table 23 - Summary of CBR Results within upper 1m

Ref	Proposed Location	Average CBR Value (%)	Road 5% CBR Compliance	Pavement 2% CBR Compliance
DP1	Paving/Road	28	Yes	Yes
DP2	Paving/Road	11	Yes	Yes

6.7 Preliminary Floor Design

The ground gas risk for the site has been characterised as a Very Low Risk and the radon risk is low and therefore only a standard membrane is required.

6.8 Soakage Potential

The results from the permeability testing indicates good permeability (>E-04 m/sec) within the chalk materials from borehole soakage tests. It is recommended that BRE365 Soakage Testing is undertaken to further assess and confirm the soakage rates onsite.

It is recommended a drainage engineer is consulted to formulate the drainage design.

6.9 Preliminary Foundation Design

Factors that will need to be considered when selecting the type and depth of foundations includes:

- Two storey buildings are being proposed
- Groundwater was not encountered within the upper 4.00m
- Made ground is present to a maximum depth of 0.30m bgl
- No areas containing soft/loose or peaty materials identified during field testing

It is understood that the proposed development comprises the construction of two detached 4-bedroom dwellings with associated garages and access. Shallow traditional strip foundations are likely to be feasible which will need to extend to a minimum depth of 1.00m into the low to medium density chalk, adopting an allowable bearing capacity of 150 kPa.

It is recommended that a structural engineer is consulted for the detailed foundation design.



7.0 RECOMMENDATIONS FOR FURTHER WORK

WDE recommends that the following items are undertaken:

- Additional verification of surface soil is undertaken following removal of ACM
- BRE365 Soakage Testing to further assess soakage rates on site



FIGURES



62A Western Road
Tring
HERTS
HP23 4BB
T: 01442 825570

Client

Nicole Oates and Susan Smith

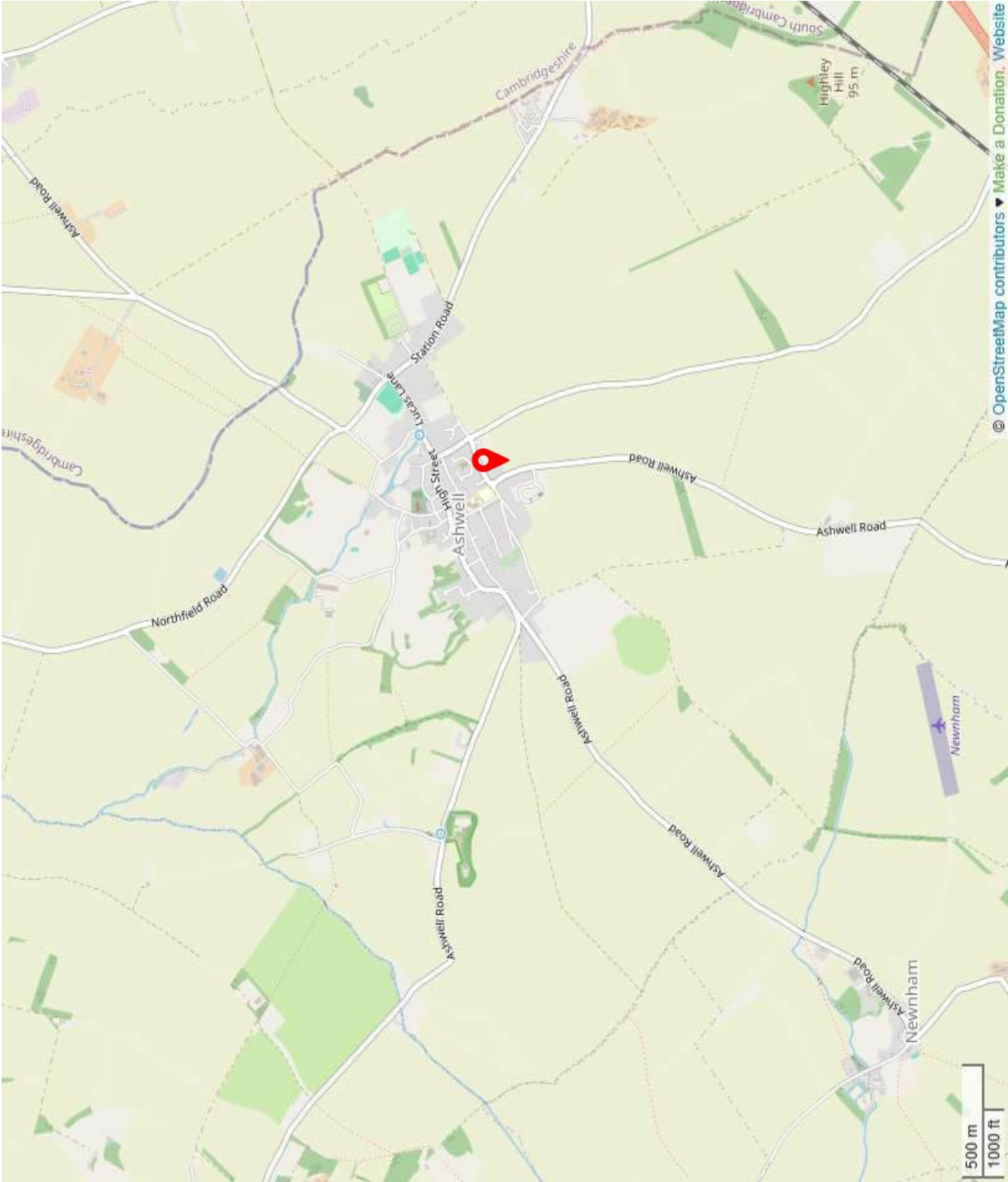
Project

21362 - Land Adjacent to 35 Ashwell
Street, Ashwell

Title

FIGURE 1: SITE LOCATION PLAN

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LEGEND

Areas of Concern

- A Potentially imported made ground
- B Trees
- C Asbestos Cement Sheetting
- D Historical Pit
- E Historical Garage

Client

Nicole Oates and Susan Smith

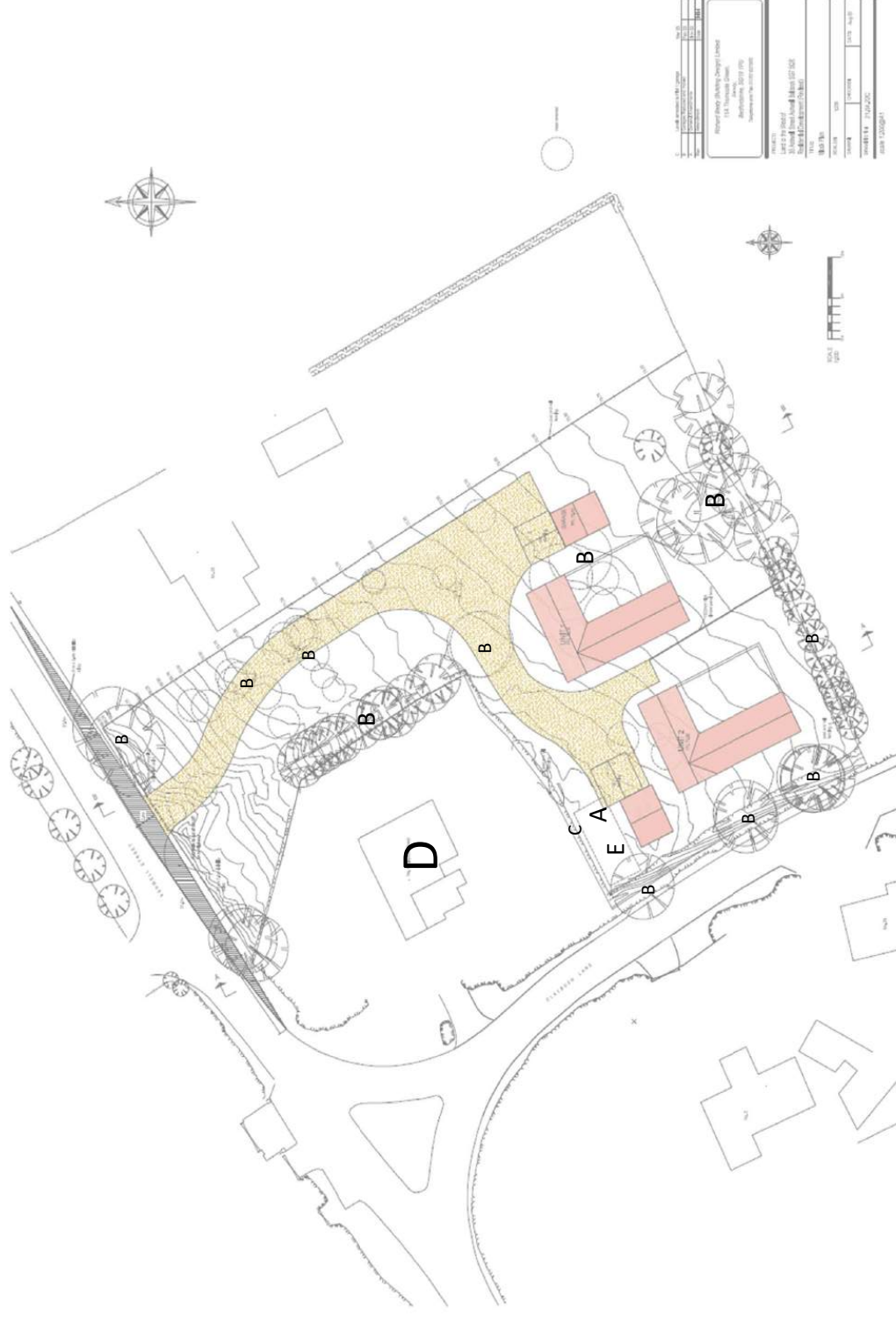
Project

21362 - Land Adjacent to 35 Ashwell Street, Ashwell

Title

FIGURE 2: PROPOSED SITE PLAN/AREAS OF CONCERN

Drawing supplied by client



LEGEND

-  Borehole
-  Dynamic Probe

Client

Ms Oates and Ms Smith

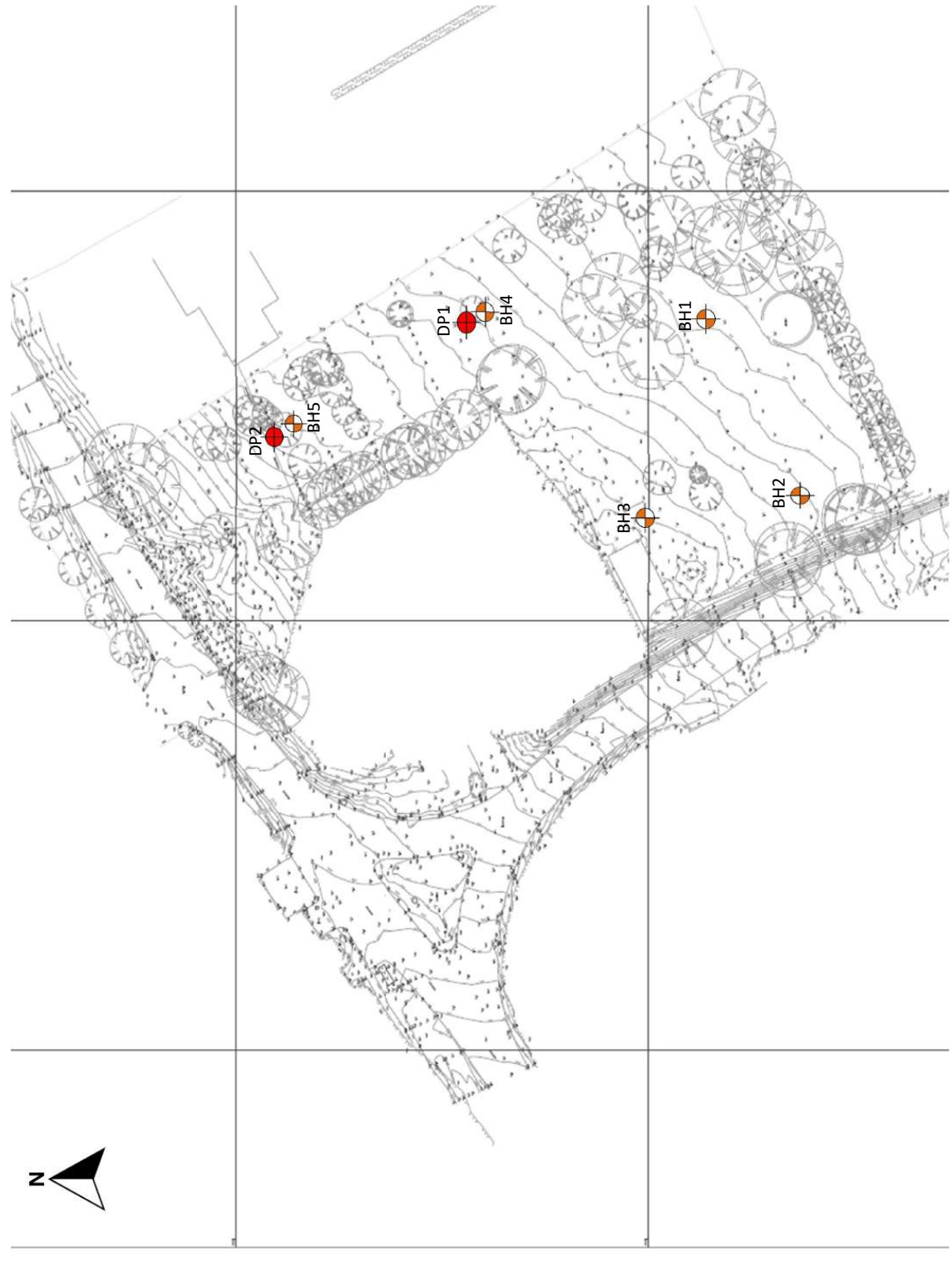
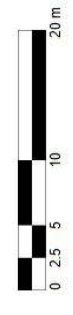
Project

**21362 - Land Adjacent to 35 Ashwell
Street, Ashwell**

Title

Figure 3 - Intrusive Location Plan

Drawing supplied by client





APPENDIX A: RELEVANT GUIDANCE AND LEGISLATION

WDE Consulting has duly taken account of the recommendation contained within relevant guidance documents and legislation during the preparation of this report.

CONTAMINATION

Part IIa of the Environmental Protection Act 1990 defined contamination in relation to continued land use and introduced the “polluter pays” principal. The Groundwater Regulations 1998 defined List 1 and List 2 substances and the procedures for preventing them from entering groundwater. The Water Resources Act of 1991 introduced the term “controlled waters” and gave powers to the Environment Agency to require remediation where there was pollution of controlled waters.

The National Planning Policy Framework² requires the following:

- The site is made suitable for its intended use, taking account of all ground conditions arising from natural and former activities, pollution arising from previous uses and proposals for mitigation including land remediation.
- After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.
- Adequate site information, prepared by a competent person, is presented.

The methodology adopted for this report follows the guidance and procedures for Land Contamination Risk Management (LCRM) produced by the Agency³. The LCRM process provides a reasoned and structured mechanism to identify potential risk issues and, where necessary, provide a way forward to develop a robust risk management strategy to address potentially unacceptable risks in an appropriate manner. Contained within the LCRM Framework are the following stages:

1. Stage 1 risk assessment
2. Stage 2 options appraisal
3. Stage 3 remediation and verification

British Standards has issued guidance for the Investigation of Potentially Contaminated Sites⁴ and for undertaking Site Investigations⁵ which have duly been considered. An update to the potential human health exposure pathways is provided in the Environment Agency Soil Science Report SR3⁶. In 2008 the Environment Agency and the National House-Building Council (NHBC), Chartered Institute of Environmental Health (CIEH) released a joint publication for the Safe Development of Housing on Land

² Department of Communities and Local Government. March 2012

³ Environment Agency. 2020. Land Contamination Risk Management (LCRM)

⁴ British Standards 2011. Investigation of Potentially Contaminated Sites-Codes of Practice. BS10175:2011

⁵ British Standards. 2015. Code of Practice for Site Investigations. BS5930

⁶ Environment Agency, August 2008, Updated technical background to the CLEA model, Science Report - SC050021/SR3

Affected by Contamination⁷. Guidance is provided in the CLR Report No 4 on sampling strategies for contaminated land⁸.

An assessment of the potential risk from PCBs is provided in the DOE which takes into account their low solubility and potential for migration within the ground⁹.

QUALITATIVE RISK ASSESSMENT

The potentially active human health are based on the Agency Soil Science Report SR3¹⁰. The potential contaminants of PCBs arising from the electricity substation located offsite have been discounted as PCBs are not considered to be sufficiently mobile or soluble¹¹.

To assess the potential for risk, the Source → Pathway → Receptor relationships have been evaluated to determine whether there are potentially active pollutant linkages between sources and receptors. Only when there is an active pollutant linkage, can there be a potential risk to a receptor from a source via a particular pathway. Each active pathway has been assigned a qualitative assessment as to the level of risk as shown in the below table and as per R&D 66⁷.

Qualitative Risk Classification Scheme

		CONSEQUENCE			
		Severe	Medium	Mild	Minor
PROBABILITY (Likelihood)	High likelihood	Very High Risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

⁷ Environment Agency. 2008. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D 66

⁸ DOE. 1994. Sampling Strategies for Contaminated Land. CLR Report No 4

⁹ Department of the Environment, 1996, Industry Profile: Engineering works. P.14 Sect 3.2.1

¹⁰ Environment Agency, August 2008, Updated technical background to the CLEA model, Science Report - SC050021/SR3

¹¹ Department of the Environment, 1996, Industry Profile: Engineering works. P.14 Sect 3.2.1

ADOPTED GACS

The Generic Assessment Criteria (GACs) that have been adopted are based on the Land Quality Management (LQM) Suitable for Use Levels (S4UL)¹². These published values are available for residential with/without home grown produce, commercial, allotment and public open space land use scenarios. As there is no current UK GAC for lead or cyanide, the Category 4 Screening Level (C4SL) will be adopted for lead and the Dutch Intervention Value (DIV) for cyanide. In the absence of any UK published value, the detection limits have been adopted.

For asbestos, there are no current GAC for asbestos fibres in soils. For surface soils within a residential/allotments setting, it is best practice to take a conservative approach and to adopt the detection limit (0.001%) as the threshold. A *very low quantity* threshold for asbestos of 0.01% had been proposed by CL:AIRE²⁷, which is considered to be appropriate for adoption within a commercial/public open space scenario.

GACs For Various Land Uses (mg/kg)

Contaminant of Concern	Residential with HGP	Residential without HGP	Allotments	Commercial	Public Open Space Res
Asbestos	DL	DL	DL	DL	DL
Asbestos Quantification %	0.001	0.001	0.001	0.01	0.01
Total Cyanide	50	50	50	50	50
Total Phenols	280	750	66	760	760
Naphthalene	2.3	2.3	4.1	190	4900
Acenaphthylene	170	2900	28	83000	15000
Acenaphthene	210	3000	34	84000	15000
Fluorene	170	2800	27	63000	9900
Phenanthrene	95	1300	15	22000	3100
Anthracene	2400	31000	380	520000	74000
Fluoranthene	280	1500	52	23000	3100
Pyrene	620	3700	110	54000	7400
Benzo(a)anthracene	7.2	11	2.9	170	29
Chrysene	15	30	4.1	350	57
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1
Benzo(k)fluoranthene	77	110	37	1200	190
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7
Indeno(1,2,3-cd)pyrene	27	45	9.5	500	82
Dibenz(a,h)anthracene	0.24	0.31	0.14	3.5	0.57
Benzo(ghi)perylene	320	360	290	3900	640
Arsenic	37	40	43	640	79
Beryllium	1.7	1.7	35	12	2.2
Boron	290	11000	45	240000	21000
Cadmium	11	85	1.9	190	120
Chromium	910	910	18000	8600	1500
Copper	2400	7100	520	68000	12000
Lead	210	330	84	6600	760
Mercury	40	56	19	1100	120
Nickel	180	180	230	980	230
Selenium	250	430	88	12000	1100
Vanadium	410	1200	91	9000	2000
Zinc	3700	40000	620	730000	81000
Benzene	0.087	0.38	0.017	27	72
Toluene	130	880	22	56000	56000

¹² LQM/CIEH 2014. The LQM/CIEH S4ULs for Human Health Risk Assessment.

Contaminant of Concern	Residential with HGP	Residential without HGP	Allotments	Commercial	Public Open Space Res
Ethylbenzene	47	83	16	5700	24000
Xylenes (sum)	56	79	28	5900	41000
MTBE	49	73	23	7900	7900
TPH - Aliphatic >C5 - C6	42	42	730	3200	570000
TPH - Aliphatic >C6 - C8	100	100	2300	7800	600000
TPH - Aliphatic >C8 - C10	27	27	320	2000	13000
TPH - Aliphatic >C10 - C12	130	130	2200	9700	13000
TPH - Aliphatic >C12 - C16	1100	1100	11000	59000	13000
TPH - Aliphatic >C16 - C21	65000	65000	260000	1600000	250000
TPH - Aliphatic >C21 - C35	65000	65000	260000	1600000	250000
TPH - Aliphatic >C35 - C44	65000	65000	260000	1600000	250000
TPH - Aromatic >C5 - C7	70	370	13	26000	56000
TPH - Aromatic >C7 - C8	130	860	22	56000	56000
TPH - Aromatic >C8 - C10	34	47	8.6	3500	5000
TPH - Aromatic >C10 - C12	74	250	13	16000	5000
TPH - Aromatic >C12 - C16	140	1800	23	36000	5100
TPH - Aromatic >C16 - C21	260	1900	46	28000	3800
TPH - Aromatic >C21 - C35	1100	1900	370	28000	3800
TPH - Aromatic >C35 - C44	1100	1900	370	28000	3800

CONTROLLED WATER EALS

In the UK there are two published Environmental Assessment Levels (EALs) available for comparison with groundwater, the Water Framework Directive¹³ and the Water Supply Regulations¹⁴, apart from TPH fractions, Ethylbenzene and Xylenes where the DWS and EQS values has been adopted, respectively. Detection Limit (DL) is used where a standard has not been derived. SoBRA have calculated the risks from vapour inhalation from volatile dissolved phase contaminants for residential and commercial human health receptors.

Adopted Controlled Water Targets (mg/l)

Contaminant of Concern	EAL	Source	SoBRA Res	SoBRA Comm
Total Phenols	0.0077	UK WFD	-	-
Cyanide	0.05	UK WSR	-	-
Naphthalene	0.002	UK WFD	-	-
Acenaphthylene	0.0001	UK WSR	-	-
Acenaphthene	0.0001	UK WSR	-	-
Fluorene	0.0001	UK WSR	-	-
Phenanthrene	0.0001	UK WSR	-	-
Anthracene	0.0001	UK WSR	-	-
Fluoranthene	0.0001	UK WSR	-	-
Pyrene	0.0001	UK WSR	-	-
Benzo(a)anthracene	0.0001	UK WSR	-	-
Chrysene	0.0001	UK WSR	-	-
Benzo(b)fluoranthene	0.0001	UK WSR	-	-
Benzo(k)fluoranthene	0.0001	UK WSR	-	-
Benzo(a)pyrene	0.00001	UK WSR	-	-
Indeno(1,2,3-cd)pyrene	0.0001	UK WSR	-	-
Dibenz(a,h)anthracene	0.0001	UK WSR	-	-

¹³ The Water Framework Directive (Standards and Classifications) Directions (England and Wales). 2015.

¹⁴ The Water Supply (Water Quality) Regulations. 2016.



Contaminant of Concern	EAL	Source	SoBRA Res	SoBRA Comm
Benzo(ghi)perylene	0.0001	UK WSR	-	-
Arsenic	0.01	UK WSR	-	-
Boron	1	UK WSR	-	-
Cadmium	0.005	UK WSR	-	-
Chromium	0.05	UK WSR	-	-
Copper	2	UK WSR	-	-
Lead	0.01	UK WSR	-	-
Mercury	0.001	UK WSR	-	-
Nickel	0.02	UK WSR	-	-
Selenium	0.01	UK WSR	-	-
Zinc	0.0123	UK WFD	-	-
Benzene	0.001	UK WSR	0.21	20
Toluene	0.074	UK WFD	230	21000
Ethylbenzene	0.02	UK EQS	10	960
Xylenes (sum)	0.03	UK EQS	31.4	3020
MTBE	DL	WDE	-	-
TPH - Aliphatic >C5 - C6	0.01	UK DWS	1.9	190
TPH - Aliphatic >C6 - C8	0.01	UK DWS	1.5	150
TPH - Aliphatic >C8 - C10	0.01	UK DWS	0.057	5.7
TPH - Aliphatic >C10 - C12	0.01	UK DWS	0.037	3.6
TPH - Aliphatic >C12 - C16	0.01	UK DWS	-	-
TPH - Aliphatic >C16 - C21	0.01	UK DWS	-	-
TPH - Aliphatic >C21 - C35	0.01	UK DWS	-	-
TPH - Aromatic >C5 - C7	0.01	UK DWS	210	20000
TPH - Aromatic >C7 - C8	0.01	UK DWS	220	21000
TPH - Aromatic >C8 - C10	0.01	UK DWS	1.9	190
TPH - Aromatic >C10 - C12	0.01	UK DWS	6.8	660
TPH - Aromatic >C12 - C16	0.01	UK DWS	39	3700
TPH - Aromatic >C16 - C21	0.01	UK DWS	-	-
TPH - Aromatic >C21 - C35	0.01	UK DWS	-	-

GROUND GAS

The following relevant guidance will be used to assess the risks posed by ground gas:

- CIRIA Assessing risks posed by hazardous ground gases to buildings¹⁵
- NHBC: Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present¹⁶
- NHBC: Technical Extra¹⁷
- The Building Regulations Site Preparation and resistance to contaminants and moisture. ¹⁸
- British Standard. Guidance on Investigations for Ground Gas¹⁹
- NHBC guidance on Hazardous ground gas²⁰
- EPG Limited. Screening Approach²¹

¹⁵ CIRIA 2007. Assessing Risks Posed by Hazardous Ground Gases to Buildings. C665

¹⁶ NHBC 2007. Guidance on Evaluation of Development Proposals on Sites where methane and carbon dioxide are present

¹⁷ NHBC 2016. Technical Extra. Ground Gas Update. April 2016. Issue 20

¹⁸ Building Regulations 2004. Approved Document C, Site Preparation and resistance to contaminants and moisture.

¹⁹ British Standards 2013. Guidance on Investigation for Ground Gas. BS8576. 2013

²⁰ NHBC 2023. Hazardous Ground Gas – an essential guide for housebuilders. NF94

²¹ EPG 2018. Screening Approach for landfill gas migration around landfill sites

The NHBC guidance²⁰ states that the landfills from the 1960s and 1970s are unlikely to be able to generate ground gas and will have a declining source. Landfills from the 2000s are not likely suitable for residential development, which leaves the landfills from the 1980s and 1990s as the most critical. Additional guidance is also available from EPG Limited²¹ which states that for landfills of 20 years, the gas generation will have reduced significantly, whereas over 40 years will have reached maturation phase and gas generation will be at very low levels. All published cases for offsite migration of ground gas have been from landfills which have either been operational or only recently closed.

Published guidance from GGS²² also emphasises the importance of a conceptual model for the relationship between source-pathway-receptor.

Summary of NHBC Traffic Light System

Gas Regime	Methane		Carbon Dioxide	
	Typical max %	Gas Screening Value (U/hr)	Typical max %	Gas Screening Value (U/hr)
Green	<1	<0.16	<5	<0.78
Amber 1	1 – 5	0.16 – 0.63	5 – 10	0.78 – 1.56
Amber 2	5 – 20	0.63 – 1.56	10 – 30	1.56 – 3.13
Red	20+	1.56+	30+	3.13+

RADON GAS

The following guidance has been followed for the assessment of the risk from radon gas:

- UK Radon www.ukradon.org
- BRE 2023. Radon Guidance²³

The UK Health Security Agency recommends that radon levels should be reduced in homes where the average is >200 Bq m⁻³ (known as the Action Level), with the Target Level of 100 Bq m⁻³. Radon potential bands for having a building that is at least as high as the Action Level, are assigned across the UK in grids, with slight variations for the required actions across the Home Nations, as seen below:

²² GGS 2024. Ground has Hazards, Desk Studies, CSM's and when not to monitor.

²³ BRE 2023. Radon. Guidance on the protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)

Radon potential band (%)	General risk	Affected area?	Test advised?	Building Control Regulations?		
				England & Wales	Scotland	Northern Ireland
0 - 1	Low	No	No#	No#	No#	No#
1 - 3	Medium	Yes	Yes	No#	Yes - Stage 1	Yes - Zone 1
3 - 5	Medium	Yes	Yes	Yes - Basic	Yes - Stage 1	Yes - Zone 1
5 -10	Medium	Yes	Yes	Yes - Basic	Yes - Stage 1	Yes - Zone 1
10 - 30	High	Yes	Yes	Yes - Full	Yes - Stage 2	Yes - Zone 2
Over 30	High	Yes	Yes	Yes - Full	Yes - Stage 2	Yes - Zone 2

Basic radon protection is relatively cheap and simple to install and requires a radon membrane, cavity tray, telescopic air vent and rigid installation. Full radon protection is more complicated and will require a radon sump chamber or a ventilated subfloor, which can if needed have extraction fan fitted.

UK WATER SUPPLY PIPES

The following guidance has been followed for the selection of water supply pipes:

- UKWIR Guidance for the selection of Water Supply Pipes²⁴
- Water UK Contaminated Land Assessment Guidance²⁵

These mainly apply to brownfield sites, although may apply to greenfield sites should the preliminary risk assessment identify there is a potential for contamination to be present.

WASTE MANAGEMENT

The EU Waste Framework Directive 2008 presents the legislative framework for the collection, transport, recovery, and disposal of waste. This framework provides a five-step hierarchical plan for managing waste comprising prevention, preparing for re-use, recycling, recovery, and disposal, which have been made into UK law via the UK Waste Regulations 2011. This requires all businesses/organisations that either produces or handles waste to either prevent waste or to apply the waste hierarchy for the transfer of waste. The Environment Protection (Duty of Care) Regulations 1991 require that transfer notes are used to identify the type of waste, volume, source and intended destination along with the details of the licensed carrier.

²⁴ UK Water Industry Research 2011. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. 10/WM/03/21.

²⁵ Water UK 2014. Contaminated Land Assessment Guidance.

The Agency have published guidance on the classification of Hazardous Waste²⁶, which defines how man-made materials are classified as being hazardous by exceeding at least one of the fifteen hazardous properties (H1 to H15). Man Made materials can either be absolute hazardous, absolute non-hazardous or mirror and if mirror then an assessment needs to be made as to whether the materials poses any of the hazardous properties before classifying the materials as being either hazardous or non-hazardous. The Agency has also published guidance on the Waste Acceptance at Landfills²⁷. Landfills are classified as to whether they can accept hazardous, non-hazardous, or inert materials. Waste Acceptance Criteria (WAC) thresholds have been set to determine the class of landfill that can accept the materials. Disposal of hazardous materials requires pre-treatment. WAC limits are not to be used for determining whether waste is hazardous.

The CL:AIRE CoP of the Definition of Waste²⁸ was developed to provide clarity on when the reuse of site won materials will cease to be waste. It requires the development of Material Management Plan (MMP) that is specific to the site and the intended reuse of materials. The MMP will need to be based on a site-specific Remedial Strategy/Design Statement that will demonstrate that the reuse of the site won materials will not pose an unacceptable risk to sensitive receptors. There will then need to be a requirement for verification that the proposed reuse has been carried out as was planned.

CLIMATE CHANGE

The UK has signed up to achieving a net zero target by 2050 under the COP 21 Paris Agreement in 2015, which requires all industry to reduce its emissions by 78% by 2035 compared to 1990 levels. Approximately 1.25% of the UK total greenhouse gases are attributable to the built environment, with CO₂ emissions amounting to 40-50million tonnes, more than for aviation and shipping combined²⁹. The use of low carbon materials, retrofitting old ones and the need for considering whole-life carbon of new buildings needs to be balanced with the need for additional housing.

The National Planning Policy Framework (NPPF) and LCRM advocates the adoption of sustainable development practices. The Sustainable Management Practices for the Management of Land Contamination issued in 2021 by CL:AIRE/SuRF-UK promote sustainability principles for all aspects of land contamination management, a summary of which is provided below.

²⁶ Environment Agency. 2013. Interpretation of the Definition and Classification of Hazardous Waste. Technical Guidance WM2

²⁷ Environment Agency. 2010 Waste Acceptance at Landfills. Version 1.

²⁸ CL:AIRE 2001. The Definition of Waste: Development Industry Code of Practice. Version 2.

²⁹ UK Parliament. Building to new zero: costing carbon in construction. First Report of Session 2022-23

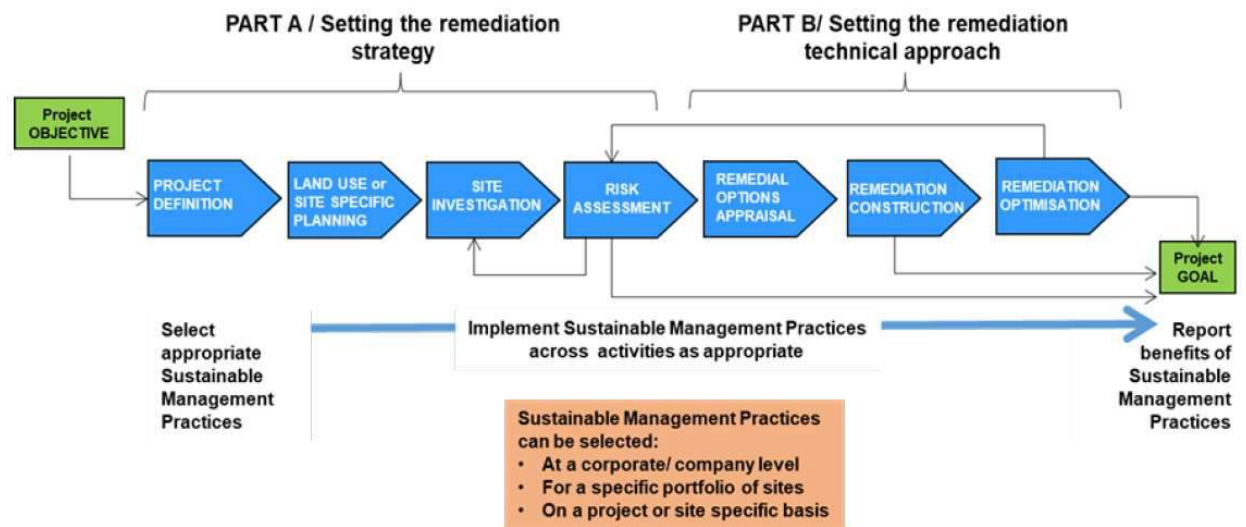


Figure 2.1: Application of sustainable management practices in context of life cycle of land contamination management and SuRF UK Framework

GROUND ENGINEERING

In accordance with BS-EN-1997-1 2004 Geotechnical Design: General Rules, engineering parameters for use in geotechnical design have been assessed using a three-step process:

1. Compilation of test data to determine a range of values for each relevant engineering parameter either by using direct results, geotechnical theory/correlations, or empiricism
2. Use of engineering judgement to determine a characteristic value for each parameter
3. Application of partial factors to give a design value for each parameter

Geotechnical site assessments were carried out in accordance where practical with the recommendations of BS EN 1997:2 2007 Eurocode 7 Geotechnical Design: Ground Investigation and Testing. This report has been written in line with the requirements of a Ground Investigation Report (GIR) as set out in BS EN 1997:2 and does not constitute a Geotechnical Design Report.

DESICCATION TESTING

There are a number of methods for determining desiccation in clay soils. These include:

Driscoll's Method

Following laboratory testing of cohesive soils, the most commonly accepted method for determining the degree of desiccation³⁰ is Richard Driscoll's method that significant desiccation has occurred when the moisture content is less than 0.4 x the liquid limit.

³⁰ BRE 1996. Desiccation in clay soils. Digest 412.

Weeks' Method

Another method for determining desiccation and first developed by Dr Alan Weeks, involves the use of a pocket penetrometer with measurements taken directly on borehole core samples³¹. The depth and extent of desiccation is assessed by comparison of penetrometer readings against a control. An assessment of desiccation can be made by comparing the results of each borehole to the profile representing equilibrium conditions for London Clay, however the technique should equally be applicable to any stiff, over consolidated, shrinkable clay and has been used successfully for Gault, Weald and Wadhurst Clays.

Liquidity Index from BRE412³⁰

To overcome issues with control boreholes and local variations in soil, it may be possible to plot the results in terms of the soil's Liquidity Index and comparing profiles of the resulting values. A value of 0 means that the soil's water content is at the Plastic Limit, while negative values indicate that the soil is drier than the Plastic Limit. Apart from these difficulties, this method often works reasonably well, and the information obtained can be used to estimate the ground heave potential.

SURFACE WATER DRAINAGE

The selection and design of surface water drainage is to follow the SuDS guidance³² which proposes the following hierarchy:

1. Management for discharge of surface water via soakaways to ground on the subject site
2. Attenuation and discharge of surface water offsite into existing drainage network
3. Discharge into combined sewer if option 1 and 2 are not feasible (such as in built up urban areas)

The following guidance has been followed during the soakage testing:

- Falling Head Tests in boreholes – BS5930⁵
- BRE Digest 365 2003 Soakage testing

The CIRIA publication³³ provides guidance as to the required distance of buildings from soakage's to ground in chalk as follows:

- 20m distance of soakaways from buildings where dissolution features are known to be prevalent
- 10m distance of soakaways from buildings where chalk is low density or unknown
- 5m distance of soakaways from buildings where chalk is of medium to high density

³¹ Proceedings of The Institute of Civil Engineers: Geotechnical Engineering. 1995, 113, 25-30

³² DEFRA. 2011. National Standards for Sustainable Drainage Systems.

³³ CIRIA. 2002. Engineering in Chalk. C574.

The CIRIA publication³⁴ provides guidance that covers design, construction and maintenance of sustainable urban drainage systems (SuDS) to assist with their effective implementation within developments.

EFFECTS OF TREES AND SHRINKABLE MATERIALS ON FOUNDATION DEPTHS

The following guidance has been followed for determining the foundation depths:

- NHBC Standards 2024 Part 4 Foundations³⁵

This document includes guidance on likely foundation depth required when taking into account the volume change potential of materials in combination with the distance to different tree species (height and water demand status).

CONCRETE DESIGN PARAMETERS

Chemical agents that can destroy concrete may be found in the ground. In the UK, sulphates and acids naturally occurring in soil and groundwater are the agents most likely to attack concrete. The effects can be serious leading to expansion and softening of concrete. Many other substances are aggressive, most resulting from human activity, but they present less of a problem since they only rarely come into contact with concrete in the ground.

The following guidance has been followed for determining the concrete design:

- BRE SD1 Concrete in aggressive grounds³⁶

This BRE Special Digest 1 (SD1:2005) guidance provides practical guidance on the specification of concrete for installation in natural ground and in brownfield locations. The procedures given for ground assessment and concrete specification cover the fairly common occurrence of sulphates, sulphides and acids. They also cover the more rarely occurring aggressive carbon dioxide found in some ground and surface waters.

PRELIMINARY ROAD DESIGN PARAMETERS

The following guidance has been followed for the preliminary likelihood of frost susceptible soils affecting the site:

³⁴ CIRIA. 2015. SuDS Manual. C753.

³⁵ NHBC Standards 2024

³⁶ BRE 2005. SD1. Concrete in aggressive ground

- Transport and Road Research Laboratory (TRRL)³⁷

Charts are available to estimate CBR test results based upon a description of soil type, construction condition and moisture content. CD225³⁸ allows the use of Table C1 from LR1132³⁹ to estimate CBR value for foundation design where no CBR measure is available.

TABLE C 1

Equilibrium suction-index CBR values

TYPE OF SOIL	PLASTICITY INDEX	HIGH WATER TABLE						LOW WATER TABLE					
		CONSTRUCTION CONDITIONS:						CONSTRUCTION CONDITIONS:					
		POOR		AVERAGE		GOOD		POOR		AVERAGE		GOOD	
		THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK	THIN	THICK
HEAVY CLAY	70	1.5	2	2	2	2	2	1.5	2	2	2	2	2.5
	60	1.5	2	2	2	2	2.5	1.5	2	2	2	2	2.5
	50	1.5	2	2	2.5	2	2.5	2	2	2	2.5	2	2.5
	40	2	2.5	2.5	3	2.5	3	2.5	2.5	3	3	3	3.5
SILTY CLAY	30	2.5	3.5	3	4	3.5	5	3	3.5	4	4	4	6
SANDY CLAY	20	2.5	4	4	5	4.5	7	3	4	5	6	6	8
	10	1.5	3.5	3	6	3.5	7	2.5	4	4.5	7	6	>8
SILT *	—	1	1	1	1	2	2	1	1	2	2	2	2
SAND (POORLY GRADED)	—	← 20 →											
SAND (WELL GRADED)	—	← 40 →											
SANDY GRAVEL (WELL GRADED)	—	← 60 →											

* estimated assuming some probability of material saturating

Table C1 reproduced from LR1132

Typically, a design CBR value of 15% is adopted for structured chalk with a minimum thickness of 450mm, with a CBR design value of 2% for highly weathered in-situ chalk.

Engineering fill used beneath roads will need to comply with the Highways Specification⁴⁰, which follows a method compaction.

³⁷ TRRL 1984 Structure Design of Bituminous Roads. Report LR1132

³⁸ CD 225. Design for new pavement foundations. 2020. Highways England

³⁹ Transport and Road Research Laboratory (TRRL). 1984. Laboratory Report 1132

⁴⁰ Series 600 Earthworks. Volume 1 Specification for Highway Works



The NHBC standards⁴¹ has provided guidance on minimum sub-base thicknesses for construction of paved areas which are summarised below.

Minimum Sub-base Thickness for Paved Areas (adapted from NHBC)

CBR Values (%)	Minimum thickness (mm) of sub-base
Less than 2	Subgrade requires improvement
2-3	325
3-5	250
5-7	150
7-20	100

⁴¹ NHBC Standards 2024. Chapter 10.2.6.4. Table 4: Minimum sub-base thickness for paved areas

APPENDIX B: SITE PHOTOS

Photo 1 - Site Overview



Photo 2 - Trees located on site



Photo 3 - Stockpiled asbestos cement sheeting



Photo 4 - Window Sampler at BH4





APPENDIX C: ENVIRONMENTAL DATABASE



APPENDIX D: FIELD LOGS



Borehole Log

BH1
Sheet 1 of 1

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362		Start Date 2025-05-13	End Date 2025-05-13

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

Inst/ Backfill	Water Levels	Samples and Tests			Level (m)	Depth (m) (thickness)	Strata		
		Depth (m)	Type/ Ref	Results			Legend	Description	
		0.30	J1			(0.30) 0.30		MADE GROUND: Brown silty clay with charcoal fragments	
						0.30		White CHALK (Grade Dc)	0.5
		1.00	SPT B1	N=93 (16,19/27,29,37,0)		(0.80)			1.0
		1.00				1.10		Refusal on very dense material	1.5
								End of Borehole at 1.10m	2.0
									2.5
									3.0
									3.5
									4.0
									4.5
									5.0
									5.5
									6.0
									6.5
									7.0
									7.5
									8.0
									8.5
									9.0
									9.5
									10.0

Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 1.10m BH	Logger CB
--	---	--------------



Borehole Log

BH1

SUPPLEMENTARY INFO

Hole Type	Easting	Northing	Ground Level (m)	Scale
BH				1:50
Project Name	Project No.	Start Date	End Date	
Ashwell Street, Ashwell	21362	2025-05-13	2025-05-13	

Client	Consultant	Contractor
Ms. N. Oates and Ms. S. Smith	Cameron Burchell	

SPT - Details

Top Depth (m) (Type)	Casing Depth (m)	Water Depth (m)	Hammer Serial No.	Energy Ratio (%)	Results
1.00 (S)					N=93 (16,19/27,29,37,0)

Sample Details

Sample ID	Type	Water Level (m)	Remarks
-----------	------	-----------------	---------

Remarks	Method, Plant, Stability, Dimensions	Logger
Groundwater not encountered	0.00 - 1.10m BH	CB



Borehole Log

BH2
Sheet 1 of 1

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362		Start Date 2025-05-13	End Date 2025-05-13

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

Inst/ Backfill	Water Levels	Samples and Tests			Level (m)	Depth (m) (thickness)	Strata		
		Depth (m)	Type/ Ref	Results			Legend	Description	
						(0.30) 0.30		MADE GROUND: Brown silty clay with charcoal fragments	
		0.50	J1					White CHALK (Grade Dm:Dc 75:25)	0.5
		1.00 1.00-2.00	SPT B1	N=23 (8,6/6,6,6,5)					1.0
		2.00 2.00-3.00	SPT B2	N=18 (5,5/5,5,4,4)		(3.70)			2.0
		3.00	SPT	N=28 (5,5/7,8,7,6)					3.0
		4.00	SPT	N=23 (5,5/6,5,6,6)		4.00			3.5
								End of Borehole at 4.00m	4.0
									4.5
									5.0
									5.5
									6.0
									6.5
									7.0
									7.5
									8.0
									8.5
									9.0
									9.5
									10.0

Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
--	---	--------------



Borehole Log

BH2

SUPPLEMENTARY INFO

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362	Start Date 2025-05-13	End Date 2025-05-13	

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

SPT - Details

Top Depth (m) (Type)	Casing Depth (m)	Water Depth (m)	Hammer Serial No.	Energy Ratio (%)	Results
1.00 (S)					N=23 (8,6/6,6,6,5)
2.00 (S)					N=18 (5,5/5,5,4,4)
3.00 (S)					N=28 (5,5/7,8,7,6)
4.00 (S)					N=23 (5,5/6,5,6,6)

Sample Details

Sample ID	Type	Water Level (m)	Remarks
-----------	------	-----------------	---------

Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
--	---	--------------



Borehole Log

BH3
Sheet 1 of 1

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362		Start Date 2025-05-13	End Date 2025-05-13

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

Inst/ Backfill	Water Levels	Samples and Tests			Level (m)	Depth (m) (thickness)	Strata		
		Depth (m)	Type/ Ref	Results			Legend	Description	
		0.10	J1			(0.30) 0.30		MADE GROUND: Brown silty clay with charcoal, tile, slate, and red brick fragments	
		1.00 1.00-2.00	SPT B1	N=18 (2,3/4,4,5,5)				White CHALK (Grade Dm:Dc 50:50)	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0
		2.00	SPT	N=19 (4,3/5,4,5,5)		(3.70)			
		3.00	SPT	N=19 (3,3/4,5,5,5)					
		4.00	SPT	N=43 (10,10/9,10,12,12)		4.00			
								End of Borehole at 4.00m	

Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
--	---	--------------



Borehole Log

BH3

SUPPLEMENTARY INFO

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362	Start Date 2025-05-13	End Date 2025-05-13	

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

SPT - Details

Top Depth (m) (Type)	Casing Depth (m)	Water Depth (m)	Hammer Serial No.	Energy Ratio (%)	Results
1.00 (S)					N=18 (2,3/4,4,5,5)
2.00 (S)					N=19 (4,3/5,4,5,5)
3.00 (S)					N=19 (3,3/4,5,5,5)
4.00 (S)					N=43 (10,10/9,10,12,12)

Sample Details

Sample ID	Type	Water Level (m)	Remarks
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Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
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Borehole Log

BH4
Sheet 1 of 1

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362	Start Date 2025-05-13	End Date 2025-05-13	

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

Inst/ Backfill	Water Levels	Samples and Tests			Level (m)	Depth (m) (thickness)	Strata		
		Depth (m)	Type/ Ref	Results			Legend	Description	
						(0.20) 0.20		TOPSOIL	
		1.00 1.00-2.00	SPT B1	N=25 (4,4/5,6,7,7)				White/pale grey CHALK (Grade Dc)	0.5
		2.00	SPT	N=30 (6,7/7,7,8,8)	(3.80)				1.0
		3.00	SPT	N=38 (5,6/9,10,10,9)					1.5
		4.00	SPT	N=25 (4,5/5,6,7,7)	4.00				2.0
									2.5
									3.0
									3.5
									4.0
									4.5
									5.0
									5.5
									6.0
									6.5
									7.0
									7.5
									8.0
									8.5
									9.0
									9.5
									10.0

Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
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Borehole Log

BH4

SUPPLEMENTARY INFO

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362	Start Date 2025-05-13	End Date 2025-05-13	

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

SPT - Details

Top Depth (m) (Type)	Casing Depth (m)	Water Depth (m)	Hammer Serial No.	Energy Ratio (%)	Results
1.00 (S)					N=25 (4,4/5,6,7,7)
2.00 (S)					N=30 (6,7/7,7,8,8)
3.00 (S)					N=38 (5,6/9,10,10,9)
4.00 (S)					N=25 (4,5/5,6,7,7)

Sample Details

Sample ID	Type	Water Level (m)	Remarks
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Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
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Borehole Log

BH5
Sheet 1 of 1

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362		Start Date 2025-05-13	End Date 2025-05-13

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

Inst/ Backfill	Water Levels	Samples and Tests			Level (m)	Depth (m) (thickness)	Strata		
		Depth (m)	Type/ Ref	Results			Legend	Description	
						(0.25) 0.25		TOPSOIL	
		1.00	SPT	N=20 (3,4/5,5,5,5)				White CHALK (Grade Dm:Dc 50:50)	0.5
		2.00 2.00-3.00	SPT B1	N=28 (5,5/7,7,7,7)		(3.75)			1.0
		3.00	SPT	N=23 (6,6/6,5,6,6)					1.5
		4.00	SPT	N=43 (8,9/9,10,12,12)		4.00			2.0
									2.5
									3.0
									3.5
									4.0
								End of Borehole at 4.00m	4.5
									5.0
									5.5
									6.0
									6.5
									7.0
									7.5
									8.0
									8.5
									9.0
									9.5
									10.0

Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
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Borehole Log

BH5

SUPPLEMENTARY INFO

Hole Type BH	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362	Start Date 2025-05-13	End Date 2025-05-13	

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------

SPT - Details

Top Depth (m) (Type)	Casing Depth (m)	Water Depth (m)	Hammer Serial No.	Energy Ratio (%)	Results
1.00 (S)					N=20 (3,4/5,5,5,5)
2.00 (S)					N=28 (5,5/7,7,7,7)
3.00 (S)					N=23 (6,6/6,5,6,6)
4.00 (S)					N=43 (8,9/9,10,12,12)

Sample Details

Sample ID	Type	Water Level (m)	Remarks
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Remarks Groundwater not encountered	Method, Plant, Stability, Dimensions 0.00 - 4.00m BH	Logger CB
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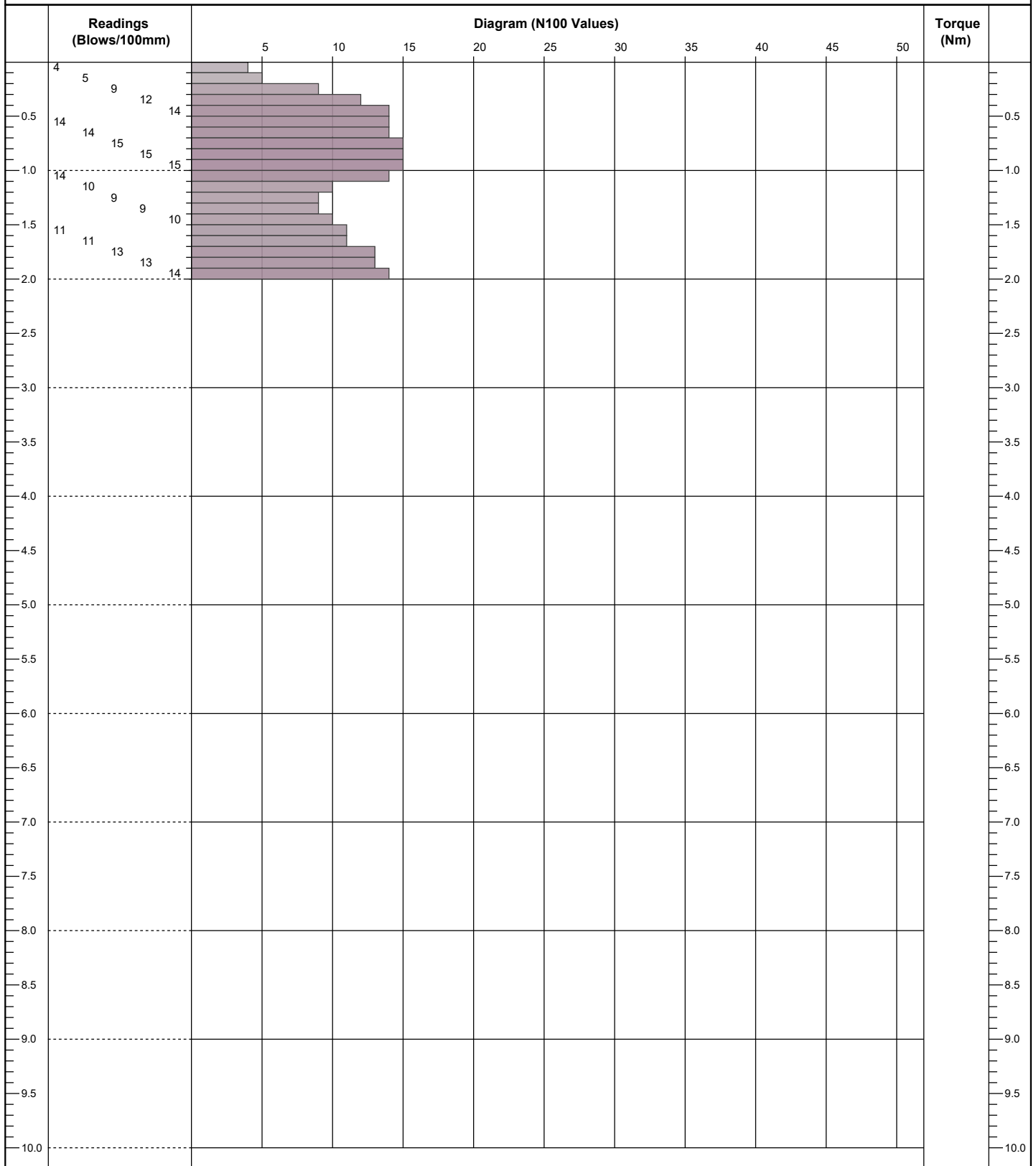


Dynamic Probe

DP1
Sheet 1 of 1

Probe Type DPSH-B	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362		Start Date 2025-05-13	End Date 2025-05-13

Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------



Remarks	Method, Plant	Logger
	0.00 - 2.00m DP	CB
	Hammer Weight (kg)	
	Hammer Drop (mm)	
	Cone Diameter (mm)	
	Cone Angle	
	Rod Diameter (mm)	
	Damper	

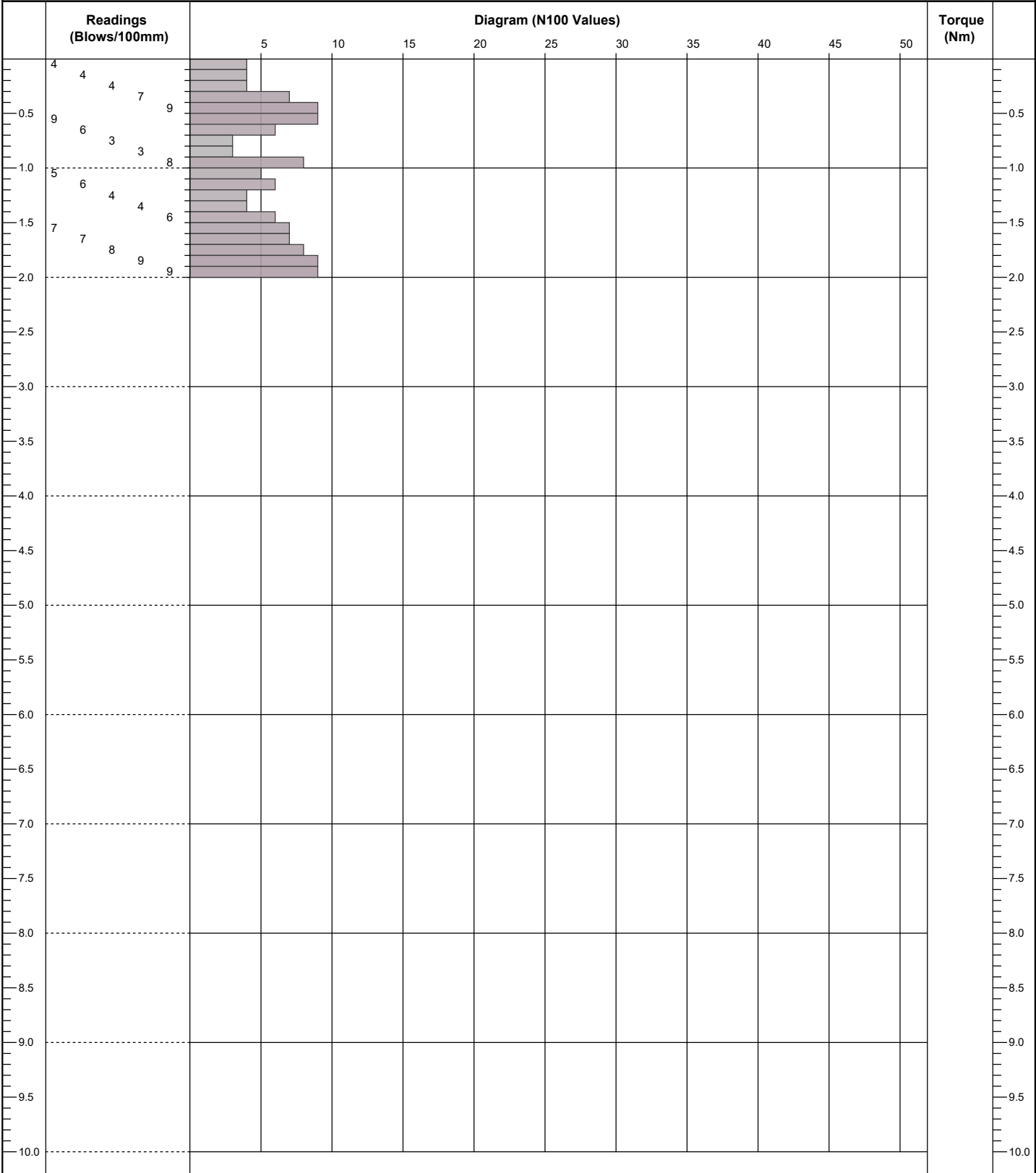


Dynamic Probe

DP2
Sheet 1 of 1

Probe Type	Easting	Northing	Ground Level (m)	Scale 1:50
Project Name Ashwell Street, Ashwell	Project No. 21362		Start Date 2025-05-13	End Date 2025-05-13

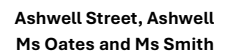
Client Ms. N. Oates and Ms. S. Smith	Consultant Cameron Burchell	Contractor
---	--------------------------------	------------



Remarks	Method, Plant 1.00 - 3.00m DP	Logger CB
	Hammer Weight (kg) Hammer Drop (mm) Cone Diameter (mm) Cone Angle Rod Diameter (mm) Damper	

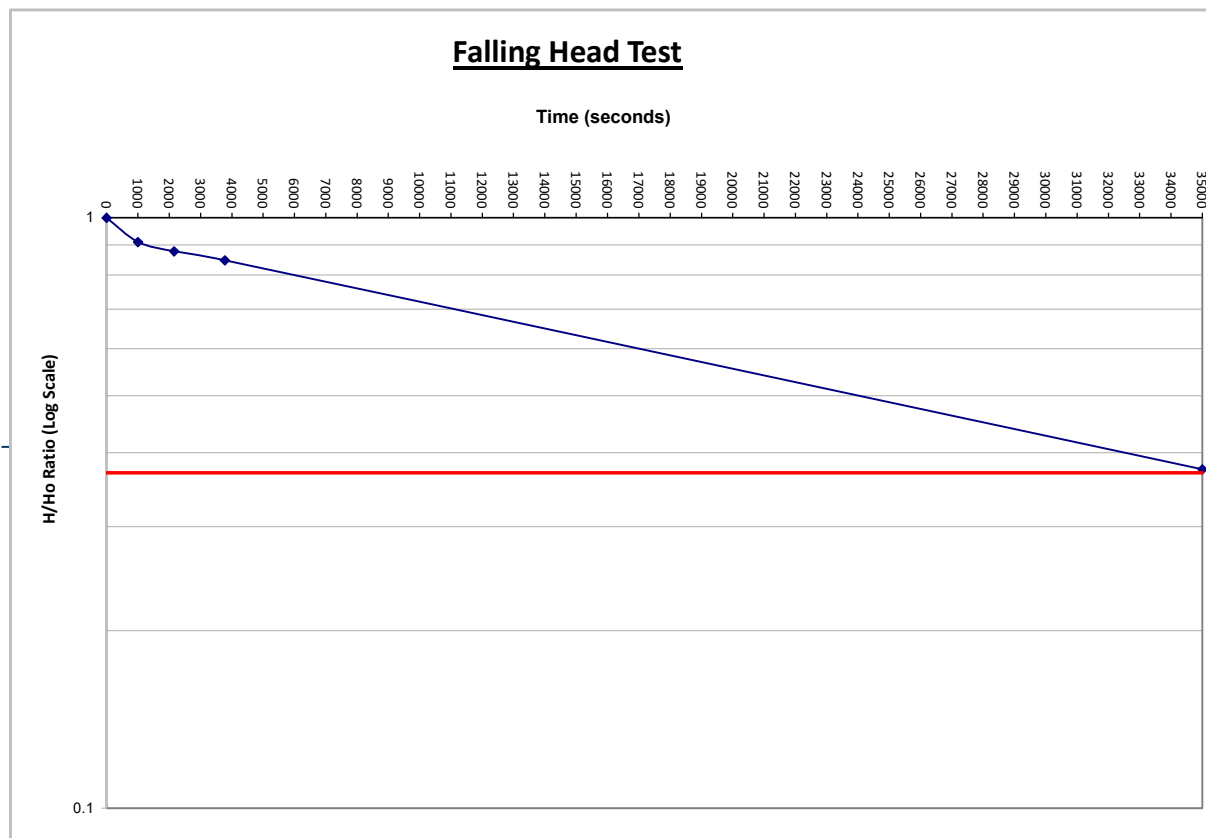


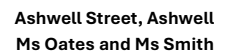
APPENDIX E: FIELD SHEETS



Comments:

Extrapolated from 3775 to 35000 seconds

[illegible]

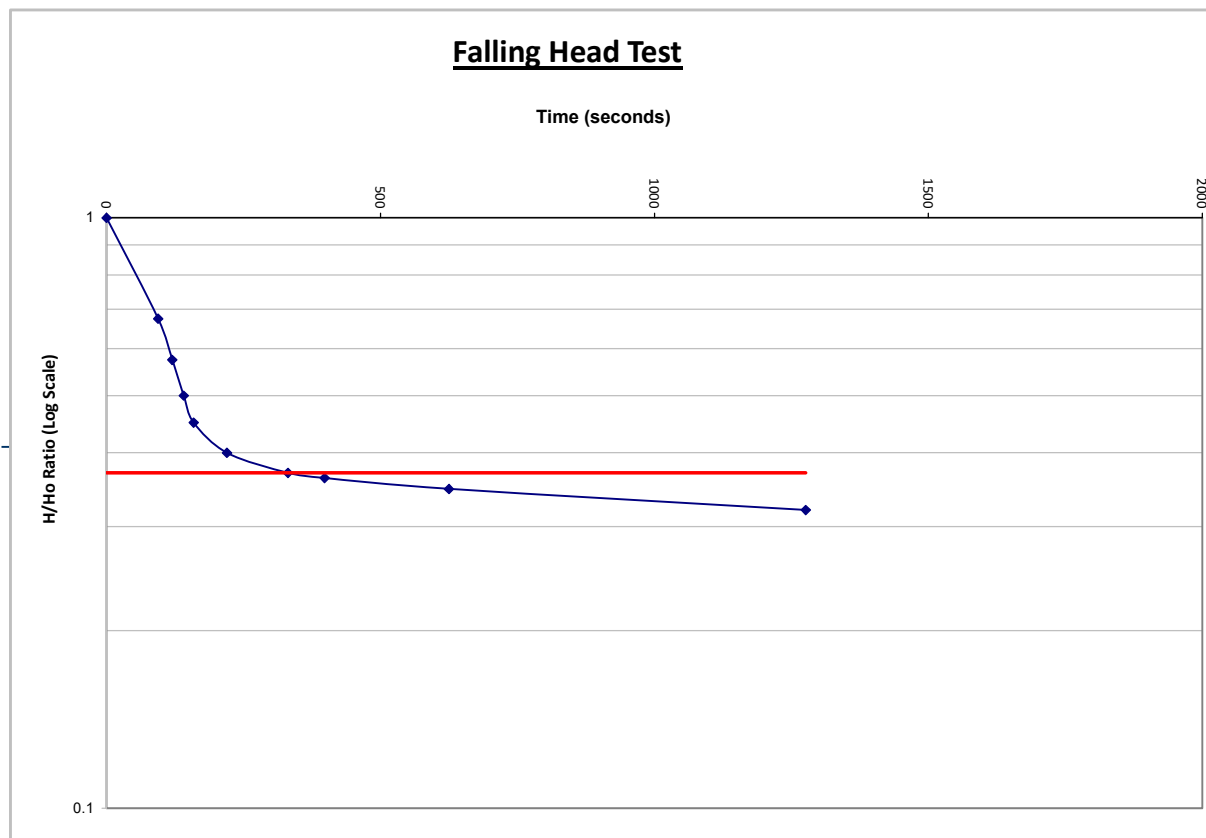


Depth to Water-M (TOC)	4.000
Diameter of well (m)	0.05

[illegible]

Comments:

Good permeability





APPENDIX F: ANALYTICAL TEST RESULTS



Below GAC	Excellence
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WDE Consulting Ltd
62a Western Road
Tring
Hertfordshire
HP23 4BB

t: 01442 825570

e: results@wdeconsulting.co.ukResults@wdeconsulting.c

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 25-025077

Project / Site name:	Ashwell Street, Ashwell	Samples received on:	15/05/2025
Your job number:	21362	Samples instructed on/ Analysis started on:	15/05/2025
Your order number:	25 228	Analysis completed by:	26/05/2025
Report Issue Number:	1	Report issued on:	27/05/2025
Samples Analysed:	3 soil samples		

Signed:

Joanna Wawrzeczko
Senior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-025077
Project / Site name: Ashwell Street, Ashwell
Your Order No: 25 228

Lab Sample Number	547007	547008	547009
Sample Reference	BH1	BH2	BH3
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	0.3	0.5	0.1
Date Sampled	13/05/2025	13/05/2025	13/05/2025
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Stone Content	%	0.1	NONE	14.3	25.4	5.5
Moisture Content	%	0.01	NONE	11	13	13
Total mass of sample received	kg	0.1	NONE	1.3	1.3	1.3

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JSW	JSW	JSW
Analysis completed	N/A	N/A	N/A	23/05/2025	23/05/2025	23/05/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.1	8.2	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	0.081	0.072	0.103
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	23	21	25
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	11.2	10.4	12.7
Sulphide	mg/kg	1	MCERTS	< 1.0	2.4	< 1.0
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.4	2	2.9

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.06	0.09	0.16
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.16	0.23	0.44
Pyrene	mg/kg	0.05	MCERTS	0.13	0.19	0.39
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.08	0.1	0.2
Chrysene	mg/kg	0.05	MCERTS	0.08	0.14	0.25
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.11	0.15	0.28
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.07	0.12
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.07	0.11	0.21
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.07	0.12
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.05	0.07	0.12

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	1.23	2.29
-----------------------------	-------	-----	-----------	--------	------	------

Analytical Report Number: 25-025077
Project / Site name: Ashwell Street, Ashwell
Your Order No: 25 228

Lab Sample Number	547007	547008	547009
Sample Reference	BH1	BH2	BH3
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	0.3	0.5	0.1
Date Sampled	13/05/2025	13/05/2025	13/05/2025
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.6	5.1	5.6
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.3	0.31	0.35
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	1.5	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	0.3	0.3
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	7.3	8	10
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13	12	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	29	33	36
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	7.4	9	9.8
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	11	11	14
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	39	44	74

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	< 8.4	< 8.4	< 8.4
TPHCWG - Aliphatic >EC5 - EC35 EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	< 10	< 10
TPHCWG - Aliphatic >EC5 - EC44 EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	< 10	< 10

TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	19	< 10	14
TPHCWG - Aromatic >EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	46	< 8.4	< 8.4
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR	mg/kg	10	NONE	19	< 10	14
TPHCWG - Aromatic >EC5 - EC44 EH_CU+HS_1D_AR	mg/kg	10	NONE	65	< 10	14

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-025077

Project / Site name: Ashwell Street, Ashwell

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
547007	BH1	None Supplied	0.3	Brown loam and sand with vegetation and stones
547008	BH2	None Supplied	0.5	Brown loam and sand with vegetation and stones
547009	BH3	None Supplied	0.1	Brown loam and sand with vegetation and stones

Analytical Report Number : 25-025077

Project / Site name: Ashwell Street, Ashwell

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	In-house method	L010-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088-PL	D/W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS

Analytical Report Number : 25-025077

Project / Site name: Ashwell Street, Ashwell

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution



APPENDIX G: GEOTECHNICAL TEST RESULTS



Tested in Accordance with: BS EN ISO 17892-2:2014, clause 5.2 and BS 1377: Part 2:2022, clause 4.2



Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Sampled By: Not Given

[illegible]

Comments:

GF 607.2



WDE RANGE OF SERVICES

